What is claimed is:

1. A method of vehicle navigation using an Active Traveling-Wave Device (ATWD), comprising:

storing information of cultural or natural features in an area of the ground along and to the sides of a movement path;

using said ATWD during movement to obtain information of said features along and to the sides of said movement path;

comparing said stored information with said information obtained by ATWD to determine successive different match points representing different ground locations;

determining the range and range rate of each of said match points;

determining the vehicle's location and velocity based on repetitive range and range rate measurements of said match points; and

supplementing the accuracy of said vehicle location and velocity determination with information from at least one of an additional navigation unit.

2. The method according to claim 1, wherein said additional navigation unit information is based upon integration of inertial measurements.

3. The method according to claim 1, wherein said additional navigation unit information represents locations between said match points and is combined with said vehicle location and velocity determination using Kalman statistical filtering.

4. The method according to claim 1, wherein a phase changing effect created by motion of said navigation unit is reduced, said method comprising:

defining subsets of a frequency hopped signal and a center frequency for each subset,

bouncing said signal off of an object and receiving a reflected version of said signal to determine a phase change in said signal;

receiving reflected versions of said subsets, and

subtracting phase effects from the samples that correspond to the center frequency of said subset.

5. The method of claim 1 wherein phase compensation is provided for said ATWD, said method comprising:

storing a pseudo-random frequency order;

changing a transmission frequency of an ATWD signal based on said pseudo-random frequency order;

using said pseudo-random frequency order to sample a received ATWD signal which is a reflected version of said transmitted ATWD signal, thereby generating samples of said received ATWD signal; and

reordering said samples in an order of increasing frequency.

6. The method according to claim 5, further comprising:

summing a group of said samples; and

performing an Inverse Digital Fourier Transform on said samples to develop a range value.

7. The method according to claim 5, further comprising:

tagging said received samples with information of their order of reception and order of frequency;

identifying a coarse range of interest based on a particular area of the ground;

selecting the received samples which correspond to said particular area;

defining signal subsets of said transmitted signal;

determining the Doppler frequencies for said selected samples and center frequencies for the subsets corresponding to said particular area;

arranging said received samples in frequency order within said subsets;

calculating the phase rotation due to transmit frequencies and receive times for the received samples, and subtracting said phase rotations from the corresponding samples according to the time order and wavelength of said sample, to thereby reduce effects of motion of the navigation unit on the interpretation of the received signals.

8. A method of vehicle navigation using ATWD, comprising:

storing information of cultural or natural features in an area of the ground along and to the sides of a movement path;

using said ATWD during flight to obtain information of said features along and to the sides of said movement path;

comparing said stored information with said information obtained by ATWD to determine match points representing different ground locations;

determining the range and range rate of said match points; and

using said range and range rate in the navigation or state vector measurements of said vehicle.

9. A method according to claim 8 wherein a phase changing effect created by motion of said navigation unit is reduced, said method comprising:

defining subsets of a frequency hopped ATWD signal and a center frequency for each subset,

bouncing said ATWD signal off of an object and receiving a reflected version of said signal to determine a phase change in said signal;

receiving reflected versions of said subsets, and

subtracting phase effects from the samples that correspond to the center frequency of said subset.

10. The method of claim 8 wherein phase compensation is provided for said ATWD, said method comprising:

storing a pseudo-random frequency order;

changing a transmission frequency of a ATWD signal based on said pseudo-random frequency order;

using said pseudo-random frequency order to sample a received ATWD signal which is a reflected version of said transmitted ATWD signal, thereby generating samples of said received ATWD signal; and

reordering said samples in an order of increasing frequency.

11. The method according to claim 10, further comprising:

summing a group of said samples; and

performing an Inverse Digital Fourier Transform on said samples to develop a range value.

12. The method according to claim 10, further comprising:

tagging said received samples with information of their order of reception and order of frequency;

identifying a coarse range of interest based on a particular area of the ground;

selecting the received samples which correspond to said particular area;

defining signal subsets of said transmitted signal;

determining the Doppler frequencies for said selected samples and center frequencies for the subsets corresponding to said particular area;

arranging said received samples in frequency order within said subsets;

calculating the phase rotation due to transmit frequencies and receive times for the received samples, and subtracting said phase rotations from the corresponding samples according to the time order and wavelength of said sample, to thereby reduce effects of motion of the navigation unit on the interpretation of the received ATWD signals.

13. A method of using ATWD to improve the errors of a vehicle navigation system comprising:

using said ATWD during movement to obtain information of cultural or natural features in an area of the ground along and to the sides of the movement path;

dynamically creating a reference scene consisting of all or a subset of the said information;

locally storing said reference scene;

using said ATWD after a time delay to again obtain information of the same said reference scene;

comparing said stored information with said information obtained by said ATWD to determine match points representing different ground locations;

determining the range and range rate of said match points in both sets of information; and

using said range and range rate and the changes in range and range rate over said time in the navigation or state vector measurements of said vehicle.

14. The method according to claim 13, further comprising:

where the dynamically created reference scene is sufficiently complex to be locally unique.

15. The method according to claim 14, further comprising:

where the dynamically created reference scene is stored with match points and their corresponding range and range rate data.

16. A method according to claim 1, wherein said ATWD is a sonar device.

17. A method according to claim 8, wherein said ATWD is a sonar device.

18. A method according to claim 13, wherein said ATWD is a sonar device.

19. A method according to claim 1, wherein said ATWD is a LASER device.

20. A method according to claim 8, wherein said ATWD is a LASER device.

21. A method according to claim 13, wherein said ATWD is a LASER device.

22. A navigation system comprising:

a memory that stores information of cultural or natural features in an area of the ground along and to the sides of a movement path;

an Active Traveling-Wave Device (ATWD) that obtains information during movement of said features along and to the sides of said movement path;

a processing system that compares said stored information with said information obtained by said ATWD to determine successive different match points representing different ground locations, said processing system determining the range and range rate of each of said match points, and determining the vehicle's location and velocity based on repetitive range and range rate measurements of said match points.

23. The navigation system according to claim 22, wherein said processing system also inputs additional navigation unit information including integration of inertial measurements.

24. The navigation system according to claim 23, wherein said additional navigation unit information represents locations between said match points and is combined with said vehicle location and velocity determination using Kalman statistical filtering.

25. The navigation system according to claim 22, wherein a phase changing effect created by motion of said system is reduced, and wherein said processing system also defines subsets of a frequency hopped signal and a center frequency for each subset, bounces said signal off of an object and receives a reflected version of said signal to determine a phase change in said signal, receives reflected versions of said subsets, and subtracts phase effects from the samples that correspond to the center frequency of said subset.

26. The navigation system of claim 22 wherein phase compensation is provided for said ATWD, and wherein said processing system stores a pseudo-random frequency order in a memory, changes a transmission frequency of an ATWD signal based on said pseudo-random frequency order, uses said pseudo-random frequency order to sample a received ATWD signal which is a reflected version of said transmitted ATWD signal, thereby generating samples of said received ATWD signal, and reorders said samples in an order of increasing frequency.

27. The navigation system according to claim 26, wherein said processing system sums a group of said samples and performs an Inverse Digital Fourier Transform on said samples to develop a range value.

28. The navigation system according to claim 26, wherein said processing system tags said received samples with information of their order of reception and order of frequency, identifies a coarse range of interest based on a particular area of the ground, selects the received samples which correspond to said particular area, defines signal subsets of said transmitted signal, determines the Doppler frequencies for said selected samples and center frequencies for the subsets corresponding to said particular area, arranges said received samples in frequency order within said subsets, calculates the phase rotation due to transmit frequencies and receive times for the received samples, and subtracts said phase rotations from the corresponding samples according to the time order and wavelength of said sample, to thereby reduce effects of motion of the navigation unit on the interpretation of the received signals.

29. A vehicle navigation system, comprising:

a memory that stores information of cultural or natural features in an area of the ground along and to the sides of a movement path;

an ATWD that obtains information during motion of said features along and to the sides of said movement path;

a processing system that compares said stored information with said information obtained by said ATWD to determine match points representing different ground locations, determines the range and range rate of said match points, and uses said range and range rate in the navigation or state vector measurements of said vehicle.

30. A navigation system according to claim 29 wherein a phase changing effect created by motion of said navigation unit is reduced, and wherein said system defines subsets of a frequency hopped ATWD signal and a center frequency for each subset, bounces said ATWD signal off of an object and receives a reflected version of said signal to determine a phase change in said signal, receives reflected versions of said subsets, and subtracts phase effects from the samples that correspond to the center frequency of said subset.

31. The navigation system of claim 29 wherein phase compensation is provided for said ATWD, and wherein said navigation system stores a pseudo-random frequency order, changes a transmission frequency of a ATWD signal based on said pseudo-random frequency order, uses said pseudo-random frequency order to sample a received ATWD signal which is a reflected version of said transmitted ATWD signal, thereby generating samples of said received ATWD signal, and reorders said samples in an order of increasing frequency.

32. The navigation system according to claim 31, wherein said navigation system sums a group of said samples, and performs an Inverse Digital Fourier Transform on said samples to develop a range value.

33. The navigation system according to claim 31, wherein said navigation system tags said received samples with information of their order of reception and order of frequency, identifies a coarse range of interest based on a particular area of the ground, selects the received samples which correspond to said particular area, defines signal subsets

of said transmitted signal, determines the Doppler frequencies for said selected samples and center frequencies for the subsets corresponding to said particular area, arranges said received samples in frequency order within said subsets, calculates the phase rotation due to transmit frequencies and receive times for the received samples, and subtracts said phase rotations from the corresponding samples according to the time order and wavelength of said sample, to thereby reduce effects of motion of the navigation system on the interpretation of the received ATWD signals.

34. A navigation system for a vehicle comprising:

an ATWD operable to obtain information during movement of cultural or natural features in an area of the ground along and to the sides of the movement path;

a processing system that dynamically creates a reference scene consisting of all or a subset of the said information, and locally stores said reference scene;

said navigation system using said ATWD after a time delay to again obtain information of the same said reference scene, comparing said stored information with said information obtained by said ATWD to determine match points representing different ground locations, determining the range and range rate of said match points in both sets of information, and using said range and range rate and the changes in range and range rate over said time in the navigation or state vector measurements of said vehicle.

35. The navigation system according to claim 34, wherein the dynamically created reference scene is sufficiently complex to be locally unique.

36. The navigation system according to claim 35, wherein the dynamically created reference scene is stored with match points and their corresponding range and range rate data.

37. The navigation system according to claim 22, wherein said ATWD is a sonar device.

38. A navigation system to claim 29, wherein said ATWD is a sonar device.

39. A navigation system to claim 34, wherein said ATWD is a sonar device.

40. A navigation system to claim 22, wherein said ATWD is a LASER device.

41. A navigation system to claim 29, wherein said ATWD is a LASER device.

42. A navigation system to claim 34, wherein said ATWD is a LASER device.